

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

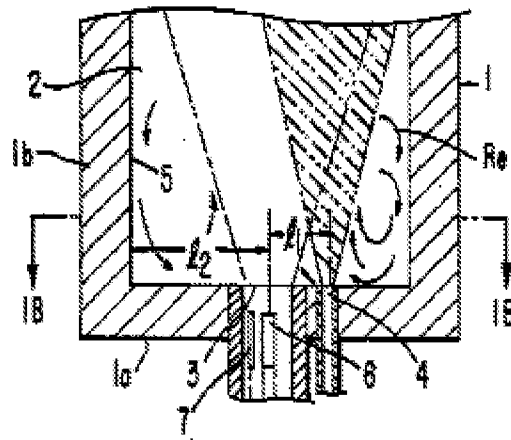
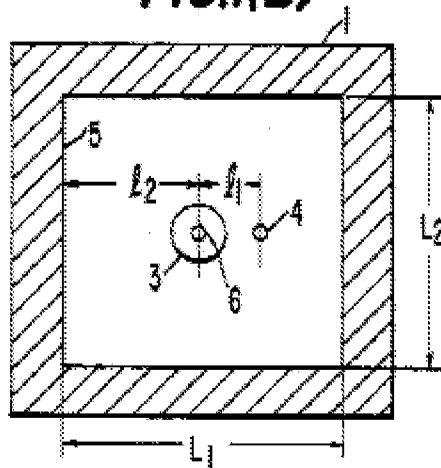
1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-5, and 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,945,841 to Nakamachi et al. ("Nakamachi") in view of U.S. Patent 6,196,831 to Dugue et al. ("Dugue").

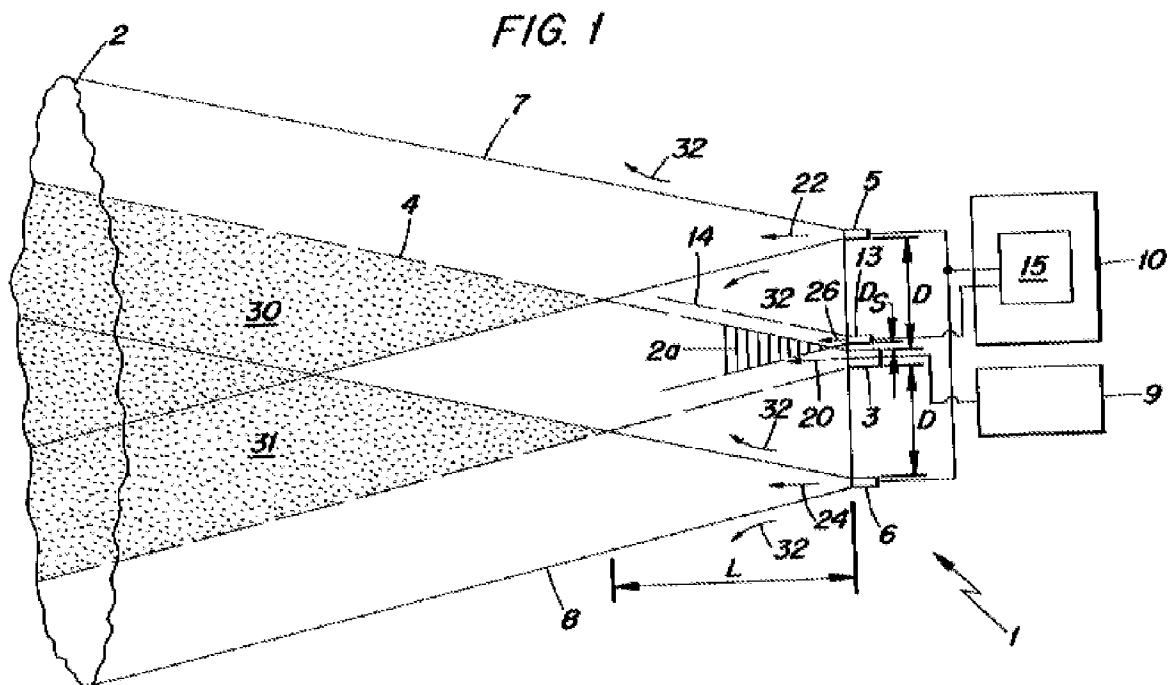
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5. In re claim 1, with reference to figures 1(A) and 1(B) below, Nakamachi discloses a method for combustion of a fuel with an oxidant in a heating furnace, wherein the fuel and the oxidant are delivered to a burner head, said method comprising: a first step of emitting fuel (6) and oxidant (3) from the burner head in the close proximity to each other, so that combustion occurs adjacent to the burner head and for a time until a temperature that exceeds the a spontaneous combustion temperature of the fuel is reached within the furnace; and a second method step of thereafter emitting the fuel (4) and the oxidant (3) from the burner head at a mutual distance apart, so that combustion occurs at a point spaced from and outwardly of the burner head (see col. 2, ll. 41-51 and col. 3, ll. 42-58).

**FIG. 1(A)****FIG. 1(B)**

6. However, Nakamachi fails to disclose that said point is at a distance of at least a diameter of the burner head.

7. Nonetheless, with reference to figure 1 below, Dugue discloses a combustion process for burning a fuel wherein fuel and the oxidant are emitted from the burner head at a mutual distance (D) apart, so that combustion occurs at a point spaced from and outwardly of the burner head at a distance (L) of at least a diameter of the burner head (disclosed graphically in figure 1 below).



8. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Nakamachi so that combustion occurs at a distance of at least a diameter of the burner head as taught by Dugue, since Dugue states that such a modification would delay combustion and cause entrainment of combustion products which thereby causes combustion to occur at low oxygen concentrations which achieves the desired effect of decreasing the generation of NO<sub>x</sub> (see col. 2, l. 62 through col. 3, l. 9). This effect is well known in the art.

9. In re claim 2, with reference to figure 1(B) above, Nakamachi in view of Dugue discloses the claimed method including wherein in the first step the fuel is emitted from a fuel nozzle (6)

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in the burner head, and the oxidant (3) is emitted concentrically around said fuel nozzle (see Nakamachi, col. 2, ll. 41-51 and col. 3, ll. 42-58).

10. In re claim 3, with reference to figure 1(B) above, Nakamachi in view of Dugue discloses the claimed method including wherein in the second step the fuel is emitted from a fuel nozzle in the burner head, and the oxidant is emitted through oxidant outlet openings (3) located on one side of and spaced from said fuel nozzle (4). (See also, Nakamachi, col. 2, ll. 56-61).

11. In re claim 4, with reference to figures 1(A) and 1(B) of Nakamachi above, Nakamachi in view of Dugue discloses the claimed method including the step of placing said the oxidant outlet openings (3) at a distance ( $\ell_1$ ) from the fuel nozzle (6) that exceeds half a diameter of the burner head. (Where  $\ell_1$  and  $\ell_2$  are variable).

12. In re claim 5, Nakamachi in view of Dugue discloses the claimed including using a gaseous oxidant that has an oxygen content of at least about 80 % (see Dugue, col. 4, ll. 19-20).

13. Therefore, it would have been obvious to one having ordinary skill in the art at the time the method was made to modify Nakamachi to use a gaseous oxidant that has an oxygen content of at least about 80% as taught by Dugue, since such a modification would ensure that there is enough oxygen for complete combustion.

14. In re claim 7, Nakamachi in view of Dugue discloses the claimed method including the step of using oil as the fuel (see Dugue, col. 2, ll. 63-67).

15. Therefore, it would have been obvious to one having ordinary skill in the art at the time the method was made to modify Nakamachi to use oil as the fuel as taught by Dugue since burners designed to use oil as the fuel source were well known in the art.

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16. In re claim 8, Nakamachi in view of Dugue discloses the claimed method including the step of using at least one of natural gas and propane as the fuel (see Dugue, col. 2, ll. 63-67).

17. Therefore, it would have been obvious to one having ordinary skill in the art at the time the method was made to modify Nakamachi to use natural gas as the fuel as taught by Dugue since burners designed to use natural gas as the fuel source were well known in the art.

18. Claims 6, 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamachi in view of Dugue as applied to claims 1 and 5 above, and further in view of U.S. Patent 5,587,283 to Karinthy et al. ("Karinthy").

19. In re claim 6, Nakamachi in view of Dugue disclose the claimed method except for disclosing the step of delivering the oxidant at an overpressure of at least 2 bar.

20. Nonetheless, Karinthy discloses a combustion process permitting reduction of NO<sub>x</sub> where oxidant is delivered at an overpressure of 12 bar.

21. Therefore, it would have been obvious to one having ordinary skill in the art at the time the method was made to modify Nakamachi in view of Dugue to deliver oxidant at an overpressure of at least 2 bar as taught by Karinthy, since such a modification would increase the velocity of the oxidant stream and ensure that complete mixing and combustion of the fuel and oxidant streams occurs at a greater distance downstream which will provide the desired effect of reducing NO<sub>x</sub> byproducts (see Karinthy, col. 2, ll. 32-45).

22. In re claim 9, with reference to figures 1(A) and 1(B) above, Nakamachi discloses a burner for combustion of a fuel with an oxidant in a heating furnace, wherein the fuel and the oxidant are delivered to a burner head, said method comprising: a first step of emitting fuel (6) and oxidant (3) from the burner head in the close proximity to each other, so that combustion

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occurs adjacent to the burner head and for a time until a temperature that exceeds the a spontaneous combustion temperature of the fuel is reached within the furnace; and a second method step of thereafter emitting the fuel (4) and the oxidant (3) from the burner head at a mutual distance apart, so that combustion occurs at a point spaced from and outwardly of the burner head (see col. 2, ll. 41-51 and col. 3, ll. 42-58).

23. However, Nakamachi fails to disclose that said point is at a distance of at least a diameter of the burner head and wherein the burner head delivers the oxidant at an overpressure of at least 2 bar.

24. Nonetheless, with reference to figure 1 below, Dugue discloses a combustion process for burning a fuel wherein fuel and the oxidant are emitted from the burner head at a mutual distance (D) apart, so that combustion occurs at a point spaced from and outwardly of the burner head at a distance (L) of at least a diameter of the burner head (disclosed graphically in figure 1 above).

25. Also, Karinthe discloses a combustion process permitting reduction of NO<sub>x</sub> where oxidant is delivered at an overpressure of 12 bar.

26. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Nakamachi so that combustion occurs at a distance of at least a diameter of the burner head as taught by Dugue, since Dugue states that such a modification would delay combustion and cause entrainment of combustion products which thereby causes combustion to occur at low oxygen concentrations which achieves the desired effect of decreasing the generation of NO<sub>x</sub> (see col. 2, l. 62 through col. 3, l. 9). This effect is well known in the art. And it would also have been obvious to one having ordinary skill in the art at the time the invention was made to modify Nakamachi in view of Dugue to deliver oxidant at an

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overpressure of at least 2 bar as taught by Karinithi, since such a modification would increase the velocity of the oxidant stream and ensure that complete mixing and combustion of the fuel and oxidant streams occurs at a greater distance downstream which will provide the desired effect of reducing NO<sub>x</sub> byproducts (see Karinithi, col. 2, ll. 32-45).

27. In re claim 10, Nakamachi in view of Dugue and further in view of Karinithi discloses the claimed invention including wherein the additional oxidant outlet openings (3) are located on one side of and spaced from said fuel nozzle(6). (See also, Nakamachi, col. 2, ll. 56-61).

28. In re claim 11, with reference to figures 1(A) and 1(B) of Nakamachi above, Nakamachi in view of Dugue and further in view of Karinithi discloses the claimed invention including wherein the additional oxidant outlet openings (3) are at a distance ( $\ell_1$ ) from the fuel nozzle (6) that exceeds half a diameter of the burner head. (Where  $\ell_1$  and  $\ell_2$  are variable).

29. In re claim 12, Nakamachi in view of Dugue and further in view of Karinithi discloses the claimed invention including wherein the additional oxidant outlet openings are at least one of Laval nozzles and venturi nozzles. (See Dugue, col. 4, ll. 51-58).

30. Therefore, it would have been obvious to one having ordinary skill in the art at the time the method was made to modify Nakamachi to use venturi nozzles as the outlet openings as taught by Dugue since burners designed to use venturi nozzles as the outlet openings were well known in the art.

### ***Conclusion***

31. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US 4988285 A to Delano discloses a reduced No.sub.x combustion method. US 4541796 A to Anderson discloses an oxygen aspirator burner for firing a furnace.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JORGE PEREIRO whose telephone number is (571) 270-3932. The examiner can normally be reached on Mon.-Fri. 9:00 am - 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steve McAllister can be reached on 571-272-6785. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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